

Claims

I claim:

1. A method of applying a liquid material onto a substrate surface, comprising the steps of:

placing the substrate surface within an enclosure;

introducing the liquid material into the enclosure; and

directing the liquid material angularly toward the substrate surface so that the liquid material flows rotationally upon contact with the substrate surface.

2. A method of applying a liquid material as in claim 1, further comprising the steps of:

pressing the substrate against the enclosure to form a seal.

3. A method of applying a liquid material as in claim 1, further comprising the steps of:

providing a cathode contact;

coupling the cathode contact to the substrate surface;

providing an anode coupled to the cathode; and

wherein the liquid material is an electrolytic bath to form an electrochemical cell.

4. A method of applying a liquid material as in claim 3, further comprising the step of:

forming a metallic film on the substrate surface.

5. A method of applying a liquid material as in claim 4, wherein the metallic film includes copper.

6. An apparatus for coating a substrate with a liquid material, comprising:

a chamber having cylindrical interior walls, said chamber having a first end and an opposing second end;

an opening in the first end for holding the substrate;

an inlet pipe coupled to the second end, the inlet pipe having an end that is directed within the chamber;

a nozzle coupled to the end of the inlet pipe, through which the liquid material is sprayed toward the substrate surface, wherein the liquid material flows rotationally upon contact with the substrate.

7. An apparatus for coating a substrate as in claim 6, wherein said nozzle further comprises a spray outlet having an elbow joint.

8. An apparatus for coating a substrate as in claim 6 wherein said liquid is sprayed out of said nozzle at an angle of approximately 20 to 60 degrees from vertical.

5 9. An apparatus for coating a substrate as in claim 8, wherein said liquid is directed toward the chamber interior walls.

10. An apparatus for coating a substrate as in claim 8, wherein said liquid is directed circumferentially with respect to the substrate surface.

11. An apparatus for electroplating a material onto a substrate surface, comprising:

- 10 a chamber having cylindrical interior walls;
- a holder for securing the substrate in place so that the substrate surface is directed into the interior of the chamber;
- a cathode contact coupled to the substrate;
- an anode coupled to the cathode;
- 15 a liquid electroplate bath introduced to the chamber through an inlet pipe;
- a nozzle having a plurality of spray outlets on the inlet pipe, the spray outlets being directed angularly toward the substrate surface so that the anodic liquid electroplate flows rotationally upon contact with the substrate surface.

20 12. An apparatus as in claim 11, wherein said spray outlets are angled at approximately 20 to 60 degrees from vertical.

13. An apparatus as in claim 11, wherein said spray outlets are pointed radially outward with respect to the center of the substrate surface.

14. An apparatus as in claim 11, wherein said spray outlets are pointed circumferentially with respect to a perpendicular direction toward the substrate surface.

25 15. An apparatus as in claim 11, wherein said plurality of spray outlets comprises at least four spray outlets.

16. An apparatus as in claim 11, wherein said plurality of spray outlets further includes at least one spray outlet pointed perpendicularly toward the substrate surface.

17. An apparatus as in claim 16, wherein said at least one spray outlet is directed toward the center of the substrate surface.

5 18. A method of electroplating a material onto a substrate surface within an enclosed chamber, comprising the steps of:

securing the substrate within an opening in the chamber so that the substrate surface faces the chamber interior;

coupling a cathode to the substrate surface;

10 coupling an anode to the cathode; and

introducing a liquid electrochemical bath to the chamber interior and directing the liquid toward the substrate surface so that the liquid flows rotationally upon contact with the substrate surface.

19. A method of electroplating a material as in claim 18, wherein the step of introducing a liquid further includes spraying the liquid out of a plurality of spray outlets.

15 20. A method of electroplating a material as in claim 19, wherein the spray outlets are directed angularly toward the substrate surface.

21. A method of electroplating a material as in claim 20, wherein the spray outlets are angled at approximately 20 to 60 degrees from vertical.

22. A method of electroplating a material as in claim 21, wherein said liquid is directed radially outward with respect to the center of the substrate surface.

23. A method of electroplating a material as in claim 22, wherein said liquid is directed circumferentially with respect to a perpendicular direction toward the substrate surface.

24. A method of electroplating a material as in claim 19, wherein at least one of the plurality of spray outlets is pointed in a perpendicular direction toward the center of the substrate surface.

25 25. A method of electroplating a material as in claim 24, wherein said plurality of spray outlets includes at least four spray outlets forming a cross pattern.

26. A method of electroplating a material as in claim 25, wherein said plurality of spray outlets further includes at least one spray outlet located at the center of the cross pattern.

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